Kilmer (F. B.)

Modern Surgical Dressings.

By F. B. KILMER.

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MODERN SURGICAL DRESSINGS.

By F. B. Kilmer.

The surgical dressings in use at the present time by such practitioners as keep pace with the advancement of the surgical art are the products of the practical application of scientific knowledge. They are the outcome of the modifications and amplification of procedures that have been brought about in the evolution of surgical science.

Dr. Wm. Pepper states that "medicine and surgery have made more progress in the last twenty years than in the twenty centuries preceding." This statement may also be applied to the surgical dressing.

In the dawn of the present era of surgery, the teachings of Lister demanded that the dressings to be applied to a wound should be saturated with chemicals capable of killing germs "within the wound or coming from without." During this epoch antiseptics were empirically applied. A dressing that promised sure death to the microbe was in demand. In those days cloth was plastered with masses of pitch, paraffin fat and carbolic acid. The products were unclean—sticky, irritating and non-absorptive—directly the opposite to those in use at the present time. Crude as was this beginning, it contained the "living spark of truth that illuminated the mysterious darkness which for centuries hovered over wound infection." It brought blessings that "have soothed and removed untold suffering and misery—have saved millions of lives. For this gift to surgery we are indebted to Sir Joseph Lister."—*Gerster.*

During the decades that have followed the time of which we speak, the forward progress of the principles of antisepsis has been continuous.

The accurate scientific observations of bacteriology has determined the value of antiseptic substances, brought a knowledge of the nature of bacteria, their habits, their life, and shown their influence in the causation of wound infection. Such knowledge has given to the surgeon newer and better weapons than those first used in the combat against wound infection. The surgical dressing has always been to the front in the revolution and evolution of surgery. Caustic applications were early substituted for those which were mild, yet more potent. Many microbe-killers were found to be man-

killers; others were shown to be valueless. Power to absorb wound secretion and exclude infection was made an essential requirement for wound-dressing material.

Prevention became both the watchword and the keystone of surgical technique. What is termed by Gerster "the conscientious practice of thorough-going cleanliness," was found possible of attainment by the use of antiseptics—"angels of cleanliness." Chemical sterilization has been combined with mechanical cleansing. Natural agents, as well as those instituted by the operator, have been called to the aid of the surgeon. In this transition, antisepsis has not been abandoned, but has developed into its higher form—asepsis. The antiseptic dressing has not been discarded, but has become aseptic. The terms antisepsis—asepsis, are not antagonistic; the one is not the antithesis of the other. "Asepsis is an exalted degree of cleanliness."

It is reached by the surgeon through the aid of antiseptics. The antiseptic agents employed to produce the condition of asepsis may be physical—heat, chemical—carbolic acid, etc., mechanical—washing. These may be supplemented by measures which exclude all bacteria. The aim sought is a condition of freedom of septic material or micro-organisms—asepsis.

The Fundamental Law.—In the transition of surgical practice, which we have noted, the great guiding principle first recognized by Lister has been strengthened, viz.: "that the presence of certain kinds of bacteria is an essential condition of wound infection." From this has been evolved the fundamental law that all materials which are to come in contact with the wound must be free from pathogenic organisms. To prepare a dressing which shall fulfil the requirements of this law would, at first glance, seem to be a simple undertaking. We find, however, that the task is not so easy of accomplishment when we note that over 150 species of bacteria are classed as pathogenic (6 pyogenic); in addition to this we have nearly 300 species of organisms classed as non-pathogenic for lack of information as to their disease producing power.[1]

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[1] Buchner has shown that many of the common saprophytes classed as non-pathogenic, when injected under the skin, cause local abscess. I have recently witnessed serious results follow an experimental inoculation of a clean wound with mould spores supposed to be harmless.

These bacteria are widely distributed.

"There is no well-defined dividing line between pathogenic and non-pathogenic bacteria."—*Sternberg.*

It would be impossible in the manipulation of dressing material to separate or remove harmless bacteria from those which may be virulent. Therefore, in its practical application the fulfillment of the law demands that surgical dressings shall be free from all forms of bacteria.

All antiseptic agents do not possess the power to destroy or kill organisms. Therefore, dressings impregnated with antiseptics will not, of necessity, meet the demand. Hence, in the preparation of surgical dressings, the law must be construed to mean that, whatever may be the material and whatever may be the methods by which it may be prepared, in order to meet the requirements of surgery, the fundamental principle governing its production must provide that it shall be free from all micro-organisms.

The Infection of Dressings.—The materials which enter into surgical dressings, such as absorbent cotton, gauze, wool, are those which, in themselves, reach after, absorb and hold bacterial life. Every person and every object with which the dressing may come in contact in the course of its preparation, are liable to transfer to it infection. Infection through air is a possible factor.

Micro-organisms are readily disseminated through the air by the medium of dust. The air of a crowded room is always laden with bacterial life. In hospitals, the air is infected through the discharges of patients. The air of a physician's office cannot be kept free from infected dust. The dust on the drug-store counters, tables and shelves will always furnish a luxuriant bacterial garden.

Wherever people move about, they must, of necessity, transfer soil and create dust. If they move from infected centres, as do the inmates and attendants at hospitals, the visitors to the doctor's office or the patrons of a drug store, they spread infected dust.

Dressings may also become infected through the water used in their preparation. The water used upon the dressings should always be that which is boiling or which has been thoroughly boiled.

A greater source of infection arises from contact with the person who handles the dressing in the course of its preparation. Here the clothing of the operator is a possible germ carrier; his body is swarming with bacteria numerous in species, in uncountable num-

bers. Skin, hair and mucous membranes, even of persons who are healthy and of cleanly habits, furnish to bacteria a natural home for growth and multiplication.

In catarrhal conditions, skin disease, or wherever there is an increase of secretions, the bacteria of the body increase both in kind and in number. These sources of infection require more than ordinary attention.

Sterilization of the entire surface of the body is impossible. Yet we are confronted with the fact that the skin secretions, perspiration, dandruff from the hair, all mucous secretions, are a fruitful source of infectious particles, fatal to asepsis if by any chance they should be transferred to the dressing. To even touch an aseptic dressing with hands not disinfected, to touch with prepared hands the eyes, nose, mouth or clothing, and then touch a dressing, would mean that infection would surely follow. Such a procedure would be an unpardonable violation of surgical cleanliness, a crime against asepsis. We must further take into account that the objects within the room where dressings may be prepared, including the air, the walls, furniture, floors, the tables upon which the dressings are laid every piece of apparatus, every object of any nature that may come in contact with the dressing, may be the means of transference of germ life. If such objects happen to be of the nature of organic material or those which hold moisture, the more readily do they become carriers of infection.

The maker of surgical dressings must have in mind, therefore, the materials of which the dressings are composed, that they are in their nature absorptive of infectious particles, that all objects connected with, all surrounding conditions, are sources through which infection may be carried to dressings during their handling and manipulation.

The Disinfection of Dressings.—Whatever the term disinfection has been made to mean elsewhere, when applied to surgical dressings it can only mean one thing—destruction of all micro-organisms in or upon the material. This process presents many varying problems. Bacteria show widely varying powers of resistance. Agents which destroy growing forms will not affect the vitality of their spores. The conditions of life and environment are all factors which must be taken into account in the disinfection of dressings. Thus, utensils and objects with smooth surfaces are readily disinfected,

because any bacteria present will be found upon their outer surface; but when bacteria are enclosed in a rock-like mass, as they are in dried dust particles, where we find them surrounded by an almost impenetrable fortress, in dried pus, sweat, in dried secretions or flesh tissue, these organisms are protected by a varnish-like coating. Bacteria, within the fibre of cotton or wool, are enclosed within a cellulose structure. Therefore, in the disinfection of cotton, wool, silk, sponge and catgut, we find that there is presented a varying problem with each material. Chemical reaction is also a factor in disinfection that has been long overlooked. In the disinfection of dressings the nature of the materials and their behavior toward the disinfecting agent must be taken into account. Thus cotton may be disinfected in a solution of soda, but wool thus treated would be destroyed.

Wool may be disinfected in an acid solution, which, in turn, would destroy cotton. Catgut is affected by most chemicals; it is destroyed by moisture. Sponge tissue is affected by many chemicals; it is destroyed by moist heat. Oily substances are impenetrable by watery solutions.

The sole universal disinfectant is fire. It destroys the infection and the infected material. It is applicable to the disinfection of asbestos dressings, which have recently been recommended for surgical purposes. There is no one method or agent which, under all circumstances, will meet all conditions. Generally, more than one agent and several methods of procedure must be used together or in succession.

The writer has made a long series of investigations, having in view the possibility of disinfecting dressings with agents that would have no reaction with the material composing the dressing, that could be readily removed from the dressing, or, when allowed to remain within the dressing material, would have no effect upon wound tissue. In these experiments, such agents as electricity, gases, vapors, friction and pressure were employed.

The general method pursued was to infect fibres with a nutrient fluid containing bacteria, to then subject the infected fibres to the action of the disinfecting agent. The results may be briefly summarized.

Electricity was not effective upon the organisms, except when electrolysis took place, as was the case when water or a solution

of salts was the medium used in the transmission of electrical energy.

Oxygen gas when under pressure had a germicidal effect, especially so when the bacteria were in a moist state. Nascent oxygen was found to be a powerful germicide. Ozone gave similar results, as did oxygen. Carbon dioxide was found to be an inhibitant, but not a germicide. The gaseous oxides of nitrogen, except N_2O were found to be powerful in their action upon bacteria, but destructive to dressing material and productive of great irritation upon inhalation. Sulphur dioxide was found to be germicidal in the presence of moisture, but inapplicable to many classes of the materials used in surgical dressings. Chlorine gas is a disinfectant, especially in its reactions which takes place in the bleaching process, namely, union with hydrogen, and consequent liberation of oxygen.

The bleaching process, therefore, effectually destroys germ life. Iodine and bromine are energetic agents in the presence of moisture, but they react destructively with materials used in surgical dressings. Formaldehyde vapors possess a high power as a germicide. The vapors are highly irritating and destructive to flesh tissue. They are, however, applicable in the disinfection of some classes of material used in dressings, and are utilized in the processes hereinafter outlined.

During the mechanical process of carding cotton and other fibres, the fibres are subjected to prolonged friction, with consequent heat and electrical action. The results upon infected fibre passed through the process were interesting, and the process was found to be one of sterilization.

Experiments numbering many hundreds of series were made to ascertain the value of pressure as a sterilizing agent upon dressing materials. The results show that infected fibres may be sterilized by a pressure of 50 to 100 tons to the square inch. This process has been utilized in the sterilization of certain forms of surgical dressings.

With the discovery of a new species of bacteria there is said to be a new chemical born for its destruction.

But in the present day practice of surgery, only in a few instances, may we use chemical germicides for the disinfection of dressings and allow the chemical to remain in the finished pro-

duct. The active chemical disinfectants are for the most part destructive to dressing fabrics as well as irritating to flesh tissue. Out of the many disinfectants lauded in days past for the impregnation of surgical dressings, but few remain. It has been found that dressings, even when impregnated with antiseptics, may still harbor germ life. In the presence of dry iodoform, dry corrosive sublimate, boric acid, germs will retain their vitality for a great length of time.

Though seemingly a contradiction of terms, it is, nevertheless, a truth born of experience to state that antiseptic dressings may be the means of conveying infection to a wound. Hence, the requirement that antiseptic dressings shall be free from micro-organisms.

In the list of agents applicable to the disinfection of dressing materials, heat ranks first in germ-destroying power. Heated air is precluded for use with cotton and some of the other substances used, for the reason that the temperature required for efficiency is destructive to the material. Heated air is quite inferior in disinfecting power to boiling water and steam. Boiling water almost instantly destroys most forms of germ-life; resistant forms succumb to its action in a few minutes.

Steam, then, holds the first place as a practical agent for the disinfection of surgical dressings. To be effective, it must be saturated (unmixed with air). Saturated or streaming steam circulating under moderate pressure reaches the efficiency and gives the results attained in boiling.

Practical Application.—Having passed in review some of the principles which underlie the preparation of surgical dressings, fitted to fulfil the requirements of surgery, we can best gain an impression as to their practical application by a brief review of the methods instituted by the author, which are now in working operation in the laboratories of Johnson & Johnson, at New Brunswick, N. J.

The buildings set apart for this work were built for this special purpose—made plain and tight to exclude dirt. They are admirably situated away from busy and dusty streets. For miles on either side stretches river and meadow-land, securing an almost dustless atmosphere. In fitting up the rooms in which the manipulations take place, the ideas kept in view were the exclusion of bacteria, easiness of keeping clean.

The walls and ceilings are glass-smooth. The floors are filled and

polished. There are no closets or shelving, no cracks or crevices to harbor dust or dirt. The furniture consists of glass-topped tables with iron frame, allowing effectual and easy cleansing. The principal part of the work is done in the "aseptic room," so called because all things within it are at all times kept surgically clean.

The following is an extract from the rules governing this room :

"Everything outside of this room, everybody and everything passing into this room from the outside are to be regarded as infected until subjected to special cleansing operations.

"Everything required for use in this room, or being brought in, must be sterilized according to the prescribed rules.

"All cleaning, sweeping and dusting must be done at the close of the day's work. Tools, apparatus, towels, aprons, aseptible clothing, etc., are to be sterilized in the sterilizing chambers. The floor must be well moistened before sweeping ; dusting must be done with damp cloths. After sweeping and dusting, the covers upon the tables must remain for at least eight hours.

"As often as may be necessary, the entire wood and iron work of the room must be washed with soap and water, then with antiseptic solutions ; the room closed and fumigated with sulphur and steam."

Everything, whatsoever may be its nature or history outside of this room, is considered as infected (though, in fact, it may be free from germ life) ; it is, therefore, disinfected before being taken into the room. The entrance to this room is through an ante-room, which is a disinfecting station of the highest type. Through this quarantine all persons and things pass before entering the aseptic room. The persons who operate in this room are under charge of graduate surgical nurses.

The following extracts from the rules in force show the methods adopted for securing personal cleanliness :

"Every person before entering the aseptic room must put on the prescribed washable garments (flowers, ornaments, jewelry, etc., must be removed). They must thoroughly wash and scrub their hands, forearms and face according to the prescribed rules.

"*Hand Disinfection.*—(1) Scrub hands, face and forearms in a solution of ammonia and soap with a disinfected brush. By the aid of a knife or nail-cleaner, scrape all particles under the nails and on the margins.

"(2) Wash again in ammonia and soap solution, then rinse in clean hot water and dry on a sterilized towel."

After this preliminary washing, operatives must pass at once into the aseptic room. Persons engaged in directly handling dressings must further put on sterilized over-dresses, caps, sleeves, etc., and again wash their hands with soap and ammonia, rinse them in clean

water without drying, rinse in a solution of oxalic acid, finally in soda and alcohol without drying. After this washing, only such objects as have been cleansed and sterilized must be handled unless the hands are rewashed. If for any reason there is cause to leave the room, the sterilized garments must be taken off, and then, before re-entering, both the preliminary and final washing be again performed. Tracing the history of a yard of gauze on its way through these rooms, its course would be somewhat as follows : It is first rendered absorbent and bleached (in an adjoining department) and arrives at the ante-room to be made into dressings. The jars in which it will be packed, with their tops, fastenings, etc., are brought to the same point from a bath in hot soda solution. If the gauze is to be impregnated with antiseptics, it is done in this outer or ante-room. The gauze, the containers, labels and all things pertaining thereto next pass into the sterilizing chamber. This chamber forms a part of the dividing wall between the ante-room and the aseptic room. The chamber is rectangular in form, large enough to hold a wagon-load of goods. It is constructed with thick walls made of metal, asbestos and other non-conducting material. The interior is lined with steam-pipe radiators for producing heated air within the chamber. Doors to the chamber open at both ends, one into the ante-room and the other into the aseptic room. These doors are steam-tight and held in place by ratchet screws.

The chambers are fitted with steam supply and escape connections, gauges for pressure and vacuum, safety valves, exhaust valves, etc. Cars of iron with trays carry the articles to be treated. Supply pipes controlled by valves admit live steam to the interior of the chamber. The actions involved in the operations within the chamber are :

(*a*) Preliminary warming of the materials to prevent condensation.

(*b*) Removal of air.

(*c*) Circulation of saturated steam unmixed with air under pressure through every fibre of the material, subjecting them to the highest possible action of this agent.

(*d*) Subsequent exhaustion of steam and substitution of heated air.

After the gauze passes into this chamber, the doors are closed and it then becomes a hot-air chamber. The air is then exhausted

to a vacuum of 10 or 12 pounds; saturated streaming steam is then let in; the temperature soon rises to possibly 240° F., and the pressure gauge indicates 5 or 10 pounds. The steam pipes are now closed; the vacuum pump is again started until the proper vacuum is obtained.

Again steam is turned on, and so on, in turn, currents of saturated steam follow each other through the vacuum for from one to two hours. Every part of the chamber is penetrated, every fibre is subjected to the action of this highest of bactericides. The most resistant form of germ life must be reached and destroyed. From the sterilizing chamber the gauze passes directly into the aseptic room. In this room, all persons, tables and apparatus having been previously prepared, the dressings are cut, folded and packed in the jars, the covers laid on loosely.

(A large portion of this work is done by apparatus, to avoid touching with the hands.)

This work is rapidly performed, and the filled jars returned to the sterilizing chambers for a re-sterilization. This final sterilization effectually secures absolute safety against the remote possibility of infection by handling. After this final sterilization the jar seals are locked. For dressings packed in jars, this process is one of hermetic sealing, a partial vacuum having been formed within the jars during their heating and cooling. The finished dressings now pass on to be labelled, put in cartoons and made ready for shipment.

These same chambers are utilized for disinfection with formaldehyde vapors, the process being: first heating of the chambers, exhaustion of the air, filling the chamber with formaldehyde vapors, which penetrate every portion of the material; finally, exhaustion of the formaldehyde vapors, which are in turn replaced with heated air.

Sterilization Tests.—The effectiveness of sterilization procedures can be readily confirmed.

In the writer's laboratory the practice is substantially as follows: A portion of the dressing material (for example, a piece of gauze) is impregnated with an infected nutrient fluid. The thus infected material is then dried in air, that the organisms may, as far as possible, be placed in a resistant condition. As a check experiment, a portion of this infected and dried material is placed in sterilized nutrient jelly in the culture chamber. This is done to ascertain whether the test material has surely been infected. The remaining

portion of the infected material is then passed through the sterilization process, care being taken that it passes through like conditions as would the sterilized dressings.

In the case of gauze or cotton, the writer's practice is to wrap the test material in the centre of the package.

In testing catgut ligatures, the ligatures are moistened and untwisted; the infected material is then rolled up within the tissue and dried. After the infected material has passed through the sterilization processes, it is placed in nutrient media in a culture chamber. After a suitable time (at least three days) if a growth is found in the check experiment, we are certain that our test material was infected. If no growth has taken place in the infected material, that has passed through the sterilization processes, we are certain that sterilization has been complete in all the dressings. This conclusion needs no verification. The dressings have been prepared and sterilized by methods which exclude contamination. If a certain portion of material purposely infected, in passing through the sterilization process with them, is rendered sterile, it is conclusive proof that the whole of the dressings cannot fail to be sterile and aseptic.

The above method of procedure applies particularly to dressings containing no chemical antiseptic. Where the dressings are so impregnated, the process is varied as follows:

To avoid the restraining influence of the antiseptic upon the growth of the test organism, portions of the infected material, after passing through the sterilization processes, are placed in quite a large body of liquid nutrient media, which is shaken to dilute the antiseptic below its normal antiseptic potency; to carry this dilution still farther, a few drops from the first dilution are passed on to a second tube of culture media.

It has been found in the use of antiseptics that enough may adhere to the organism (especially to spores) to restrain development, though not destroying their vitality. This is obviated even in the use of strong solutions of an antiseptic by the dilution above mentioned.

In testing with antiseptics the test material is kept under a cultivation for at least a week. Development is often so retarded by the antiseptic tending to make hasty conclusions erroneous. In these tests with antiseptics, liquefied flesh—peptone—gelatine of Koch is usually employed.

Where no antiseptic has been employed, sterilized potatoes and other solid media have been found convenient.

The required test is the presence or absence of a growth which will liquefy solid media or produce form, color or odor characteristic of bacterial colonies.

This is verified when deemed necessary by a microscopical examination. In surgical bacteriology, the bacillus of anthrax is used as the standard test organism; whatever will destroy the vitality of this bacillus will destroy all the known organisms of wound infection.

Who Should Make Surgical Dressings.—In the past, dressing materials were largely the product of domestic industry and convict labor. We could not now tolerate supplies from such disease-breeding sources. In recent discussions by surgical authorities, the question has been raised as to the relative fitness of the surgeon, the pharmacist and the manufacturer as makers and purveyors of surgical materials.

The apostle of modern surgery manufactured "Lister's Gauze" in his own kitchen. Sir Joseph's kitchen is doubtless a more fitting place for such work than is the office of many of his followers. Doctors' offices are not, as a rule, the most wholesome spots. Their upholstered furniture is in constant contact with the clothing and persons of patients carrying infections of every name and kind. Their tapestried carpets are filled with dust brought from pest-laden households. In the doctor's office we will find that tables, shelves, books and apparatus are spattered with debris from urinal examinations, pus from foul sores, dried excretions from diseased skin, pathological tissue, clotted blood and dried discharges from innumerable sources.

Streams of infectious matter continually pour into the rooms of the busy doctor and find a lodging-place in its paraphernalia. The unfitness of such surroundings for the production of surgically clean dressings is evident.

I claim for the American physician the highest of honors. I all but reverence the skill and genius of the American surgeon; but before I would attempt to prepare aseptic dressings in their offices, I should, in most cases, require that they be first cleansed and disinfected upon the lines adopted by health authorities for the purification of infected premises.

A certain hospital claims that its operating room is "the cleanest

place in the world." All hospitals have not earned such a title. Many of them are attached to medical colleges where students and professors gather fresh from the dispensary clinic, from visits to infected houses, from dissecting rooms, from hundreds of sources of contagion.

Clinging to their persons and clothing may be found particles rich in pyogenic and pathogenic bacteria. In hospitals, the aggregation of infectious organisms cannot be avoided. Formerly, they were "hot-beds of infection." Now dangers are excluded only by the most rigorous procedures.

When dressings are prepared by the pharmacist, the work is generally performed in the drug store back room. This place comes far short of the conditions known as surgical cleanliness. The chemically clean graduate is still unclean in the eye of the surgeon. Counters covered with vegetable and animal drugs of all kinds are not suitable places upon which to lay absorbent gauze. Street and store dust, spatterings of syrups, extracts, oils, and all manner of decoctions, create a favorable lodging- and breeding-place for organic life. These are not wanted in surgical dressings. The pharmacist, though ordinarily clean in person and habits, familiar with soap and water in the pursuit of his calling, yet he is far from aseptic. Like the physician, he is constantly in contact with infection through the person of his patrons.

The hands that dispense beef tea at the soda counter, or that bring a jar from a mouldy cellar, should not touch sterilized material without cleansing. Thus there must be a radical change of environment before the pharmacist can attain success in aseptic technique, though he may, perhaps, rightfully claim conditions and facilities that are above those of the ordinary physician.

The facilities of the manufacturer, whose whole organization is adapted to the production of surgical dressings, are certainly more perfect than those of the surgeon, to whom such work is incidental. The environment of a room from which pathogenic organisms and septic matters are entirely excluded is superior to that obtained in the hospital or in the doctor's office. The room in which no work is undertaken except the handling of aseptic material will certainly be more nearly surgically clean than one to which infection has constant access. Persons whose only calling is that of preparing surgical material, who have been schooled in the principles under-

lying the infection and disinfection of dressings, are probably more competent to handle dressings than the doctor's student or his attendants, to whom such work is of necessity relegated. In this work, as in many other instances, properly constructed apparatus is more efficient, more cleanly, more perfect, than hand work.

Further, an organization devoted exclusively to the manufacture of dressings, once having the details arranged to prepare a yard of dressing, can produce any number of yards more perfectly than if done as occasion may require, as is the rule in the hospital or in private practice.

To the manufacturer and dispensing pharmacist is due the credit of having made possible the universal application of the principles of modern surgery. They have supplied to the practitioner in the most remote regions appliances as perfect as those used in the great hospital centres. They have placed in the hands of the practitioner appliances that fulfil every requirement of the advanced art of surgery.

I hold that the preparation, selling and dispensing of medicinal and surgical supplies to the doctor, to the surgeon and to the pub lic belong to pharmacy. Their application is the province of the practitioner of medicine and surgery, and I maintain that it will be to the betterment of surgery to receive all dressing materials from the hands of a competent pharmacist.

Training for the Work.—It is important that persons who are to handle surgical dressings in any capacity be familiar with the principles as well as the details of the work. They should also know why things are done as well as how to do them. The principles of surgical asepsis are applicable to the dispensing and sale of these materials. Therefore, the following epitome of a course in aseptic technique, devised for use in the writer's laboratory, may be found useful to many pharmacists.

In addition to the daily manual training under experienced persons, the operatives are required to attend stated instructions. These instructions are in the form of demonstrations of the processes, with an explanation of the principles involved. Those in attendance are given questions to be answered and experiments to perform. Text and reference books are furnished. The scheme is modeled upon the plan of a college extension course. Among the subjects are the following:

(1) The work of preparing surgical materials, its importance, its requirements.
(2) Definition and meaning of terms.
(3) Nature of the material used in dressings. (Fibres, cloth, ligatures, etc.)
(4) Preparation of materials, bleaching, rendering absorbent, etc.
(5) Kinds of dressings used in modern surgical practice.
(6) Uses to which dressings are put in surgery.
(7) Bacteria, their nature, conditions of growth, multiplication, products of their activity, with demonstrations of the means by which they may be transferred to and from persons and things.
(8) Wound infection.
(9) Infection of dressings.
(10) Disinfection—chemical agents and physical agents.
(11) Exclusion of bacteria.
(12) Sterilization.
(13) Disinfection of persons and things.
(14) Asepsis and aseptic technique in the preparation of dressings.

The entire course in my practice occupies several months—in fact, becomes a continuous course, as additional methods are constantly brought into practice.

Surgical Dressings in Commerce.—Dr. Gerster, in one of his addresses, condemned the use of ready-made products as sold in the drug store, on the ground that the gauge of success is purely commercial, only directed solely to profit.

Another writer affirms that the standard of such dressings is commercial in nature, the essential requisite being profit, and that they must be sold to meet competition. That in this the requirements of surgery are matters of indifference and generally matters of ignorance.

These statements were corroborated in a recent instance by a druggist in one of our large cities, who is commercially wise. He stated that to him quality, kind or make was no factor. Low prices were the sole criterion of value. Responsibility hovers over every field of the pharmacist's activity in dispensing dressings; we share the burden with the surgeon. Whoever has stood beside the surgeon in his operating room and realized how much depended on not only the hand, the training and the skill of the operator, but the absolute cleanliness in every movement, must realize that there are some things that cannot be expressed in a money ratio.

At such a time and in such a place the integrity of the dressing rises to supreme importance. Any neglect in its preparation, any misstep through the ignorance, cupidity and stupidity of any who

have had to do in its history, is sure to be revealed. The issue of life or death in such a case should not be subject to the market rates per pound or yard. What results must follow the very common practice of dispensers who open packages of dressings, measure and weigh them over dusty counters with unclean hands, and send them on their mission? It would be more humane, perhaps, to send a lethal dose of strychnine. In the light of asepsis, to dispense morphine for quinine becomes a virtue when compared with the wilful contamination of a surgical dressing.

Poisons are put under lock and key, dispensed under rigid systems of precaution and checking.

The importance of the surgical dressing, the nature of its requirements, call for equal care. There is no article in the druggist's stock which should receive greater care and judgment. Upon every yard of gauze, sponge or ligature he dispenses hangs, perhaps, the life and death of a patient and the reputation of a surgeon. They should be guarded from every channel of direct or indirect infection.

A closet or a room, or a case should be provided for their reception that is cleanable; it should be cleaned often and kept clean. They should be sold within the containers in which they are packed in their preparation. They should never be broken open for sale or for any other purpose. They should be delivered to the surgeon so perfect that there can be no question as to their integrity, placing all the responsibility for their subsequent care in his hands. In dispensing to the public, every purchaser should be cautioned as to their nature and instructed in their handling and use. The price should meet the cost of the dressing plus a profit which will cover this service of advice, trouble and care.

Ninety-five per cent. of the 100,000 physicians in our land who apply these principles of surgery must look to the pharmacist for their dressing materials. In filling this demand, the pharmacist should supply such materials as will meet the highest surgical requirements. As far as the dressing is a factor, the surgeon at the country cross-roads, by the aid of the pharmacist, should be enabled to reach the advanced methods of the metropolitan clinic.

To attain this end in the making, in the buying, in the sale and in the dispensing, even to the most minute detail, there is required knowledge, skill, ability and finally a faithful application of the same.